ID No.
SYL-L326
- RETURN TO -
INSTRUMENT CONTROL
SYLVANIA SES -- West

SIN 326

MODEL 159UHF MEGACYCLE METER

Operating INSTRUCTIONS

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MA24301

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MEASUREMENTS
A McGRAW-EDISON DIVISION
BOONTON NEW JERSEY

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FOREWORD

Additional information with regard to the applications and maintenance of this equipment will be available from time to time. Users of the Model 159 UHF Megacycle Meter are urged to discuss their problems with us and to suggest such modifications as might make the instrument more adaptable to their special requirements.

Whenever possible, maintenance difficulties should be reported to Measurements before proceeding with the actual repairs. Through our familiarity with the instrument, we are in a position to suggest the most expedient and accurate repair procedure.

Your Model 159 UHF Megacycle Meter has been designed and manufactured to the highest standards of instrument quality. With reasonable care, many years of trouble-free service can be expected of it.

Megacycle meters are available in the following ranges;

Model 159 LF 0.1 to 4.5 Megacycles.
Model 159 RF 2.2 to 420 Megacycles.
Model 159 UHF 420 to 940 Megacycles.

The Model 159 Power Supply is a common source of power for these three Megacycle Meters.

Engineering Department
MEASUREMENTS

A McGraw-Edison Division

Boonton, New Jersey

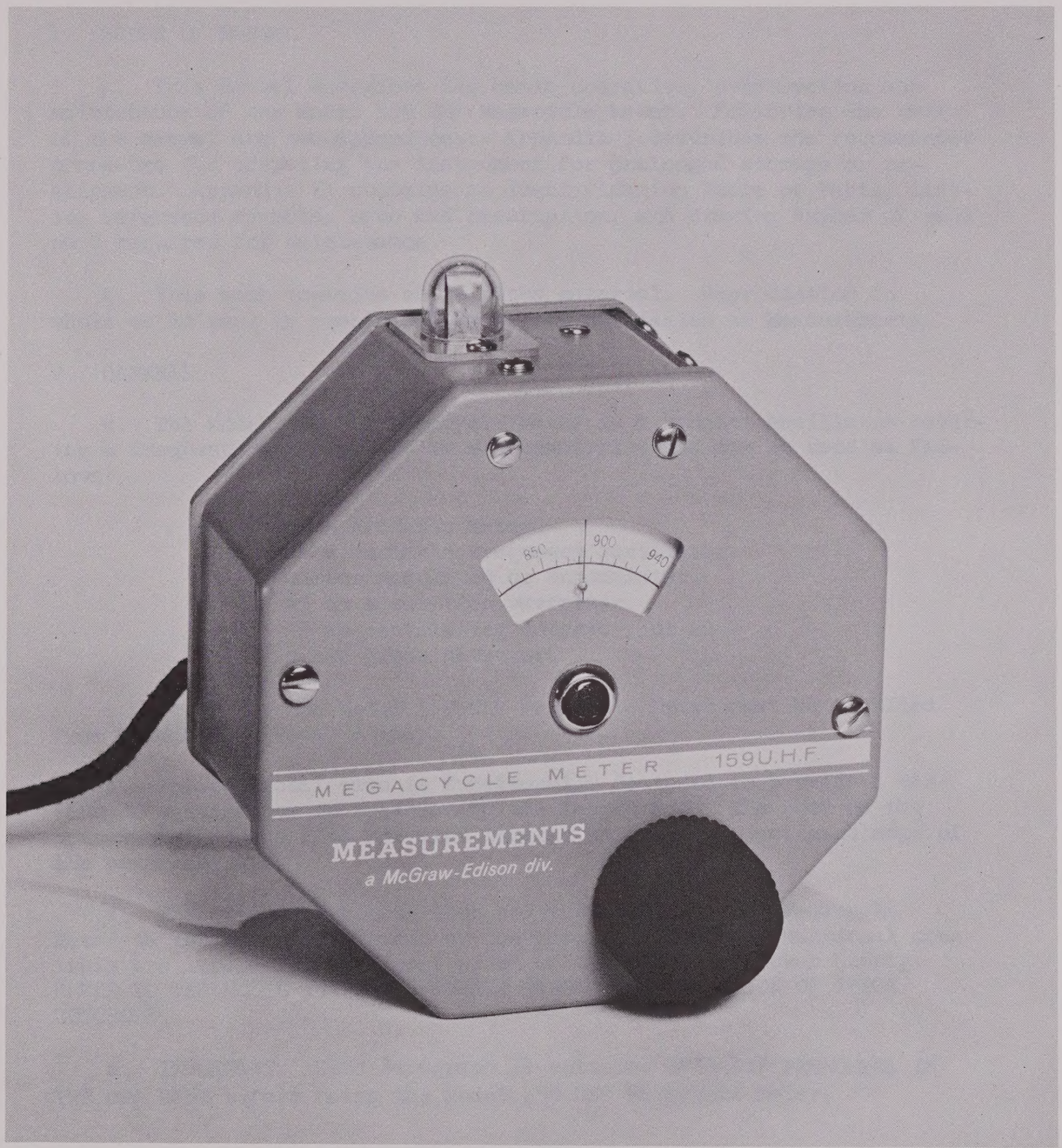

FIGURE 1. MODEL 159 UHF MEGACYCLE METER

CHAPTER 1

INTRODUCTION

1. SCOPE OF MANUAL

a. This manual describes the basic operation, construction and maintenance of the Model 159 UHF Megacycle Meter. Following the text of the manual are two appendices. Appendix I describes the recommended procedure for preparing the instrument for prolonged storage or re-shipment. Appendix II contains an Identification Table of Parts, listing reference symbols, name and description, and drawing number of each part required for maintenance.

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2. GENERAL

a. The Model 159 UHF Megacycle Meter is a compact oscillator covering a frequency range of 420 to 940 megacycles and may be used as follows:

1. As a grid-dip meter.
2. As a variable frequency oscillator, either modulated or unmodulated.
3. As an absorption wavemeter.
4. As an oscillating detector, or as a tuned diode detector.

b. Power for the Model 159 UHF Megacycle Meter must be supplied from a Model 159 Power Supply.

c. The octagonal case is functionally designed to provide a maximum of convenience in positioning the instrument. The hook on the bottom of its case fits the slot located on the top right hand edge of the power supply.

d. The frequency tuning knob for the Model 159 UHF Megacycle Meter is located on the front of the Meter. All other functional controls are located on the front panel of the Model 159 Power Supply. REFER TO THE MODEL 159 POWER SUPPLY MANUAL FOR OPERATION OF THESE CONTROLS.

e. IMPORTANT. Read Paragraph 14 entitled GRID-DIP PHENOMENA IN THE UHF BAND before using the Model 159 UHF Megacycle Meter.

3. TECHNICAL CHARACTERISTICS

a. FREQUENCY CHARACTERISTICS:

1. Continuously variable from 420 to 940 megacycles in one range.

b. FREQUENCY CALIBRATION:

1. Each unit is individually calibrated every 10 megacycles to better than 2% accuracy. However, the accuracy obtainable under operating conditions depends on the technique of the user. This technique is described in Paragraph 13.

2. The calibration is virtually linear over the entire frequency range.

c. MODULATION:

1. Internally from Power Supply, 120 cycles, or externally as selected.

d. POWER SOURCE:

1. Model 159 Power Supply.

4. COMPONENTS SUPPLIED

Quan.	Description	Dimensions			Weight
		Height	Width	Depth	
1	Model 159 UHF Megacycle Meter	3-5/8"	4-5/8"	4-5/8"	1#
1	Manual of Operating Instruction				
1	Tube, 6AF4A Installed				

MAINTENANCE

CHAPTER 2

OPERATING INSTRUCTIONS

5. INSTALLATION

a. The Model 159 UHF Megacycle Meter is completely portable and requires no permanent installation.

6. PRELIMINARY OPERATIONAL CHECKS

a. Insert the six-prong plug at the end of the flexible cable of the Model 159 UHF Megacycle Meter into the six-prong receptacle at the rear of the Model 159 Power Supply.

b. Insert the 3 wire power cord into the 3 prong receptacle at the rear of the Model 159 Power Supply and to a power source of 115 V 50-60 cycles AC.

c. Switch power on by rotating the Sensitivity Control in a clock-wise direction. The lighted meter face will indicate that the power is applied. Allow one minute for the tube to warm up. Adjust the Sensitivity Control for an on-scale reading.

d. A regulator tube is located in the Model 159 Power Supply and should be ignited for proper operation.

CHAPTER 3

MAINTENANCE INSTRUCTIONS

7. GENERAL

a. Preventive maintenance procedure is not recommended for the Model 159 UHF Megacycle Meter. Preventive maintenance is a series of operations including inspection, adjustment, lubrication, etc., recommended periodically for certain types of equipment to eliminate the possibility of unexpected interruptions in service. Critical adjustments may be disturbed by to-frequent inspection by personnel unfamiliar with the design of the Model 159 UHF Megacycle Meter. This may result in maladjustments causing errors in data that would be much more serious than an occasional operational failure.

8. CIRCUIT FAILURE

a. Most circuit failures will be evident from indications of the grid current meter M1, and reference to the schematic diagram. Failure to oscillate may result if the unit is dropped.

b. If failure occurs, the instrument should be checked by the procedure outlined in Paragraph 6, and if trouble other than a defective tube is indicated, the instrument should be returned to Measurements.

8. Circuit Failure (Continued)

c. If the seal on the instrument is broken without the permission of Measurements, the one-year guarantee will be void.

9. TUBE REPLACEMENT

a. To replace the 6AF4A tube, remove the tuning knob, remove the screw in the sealed cup washer at the center of the cover, remove the screws located on the right and left edges of the top cover and remove four screws holding the side. Do not disturb the two screws above the fiducial. Lift the cover off. Further disassembly is not recommended.

b. By trying a few 6AF4A's the tube best suited to match the original dial calibration can be found. Minor adjustments in the calibration may be made by loosening the two screws holding the fiducial and rotating it slightly.

10. RECOMMENDED EQUIPMENT

a. The only test equipment required is that which is necessary for checking frequency calibration. A Model 111 Crystal Calibrator for checking each 10 megacycles point is recommended.

CHAPTER 4

TECHNICAL SERVICE

11. SCOPE

The purpose of this chapter is to acquaint operating and maintenance personnel with the theory of operation of the various circuits in the Model 159 UHF Megacycle Meter.

12. CONCENSED THEORY OF OPERATION

a. V101 is connected in a Colpitts type oscillator circuit with the inter-electrode capacitance of the tube providing the feedback.

b. The oscillator is tuned by means of a split-stator type capacitor, C101 and C102.

c. L101 is the tank inductance formed by the loop in the plastic housing. The oscillator is coupled to external circuits to be tested by means of L101.

13. COUPLING

a. In general, the Model 159 UHF Megacycle Meter may be coupled to circuits using the same techniques as are employed with lower frequency grid dip oscillators. The coupling may be either inductive or capacitive, depending on the particular application.

b. For coupling at a low impedance point, inductive coupling is recommended (See Fig. 2a).

13. Coupling (Continued)

c. For coupling to a high impedance point, capacitive coupling is recommended (See Fig. 2b)

d. To obtain maximum inductive coupling, the orientation of the Model 159 UHF coil is important. The orientations for maximum and minimum inductive coupling in a typical case are illustrated in Fig. 3.

e. For high-Q circuits sufficient capacitive coupling may be obtained by bringing the high-impedance point of the circuit in close proximity to the Model 159 UHF coil. The best coupling position may by found by experiment.

f. The greatest frequency accuracy of the Model 159 UHF can be obtained by proper use of the instrument. In general, if the coupling to the circuit under test is too close, the oscillator will be detuned or "pulled". To obtain the greatest accuracy, couple the Model 159 UHF tightly to the circuit under test for the initial search of a dip in grid current or zero beat. After the initial indication is obtained, decrease the coupling as much as practicable while still obtaining an indication.

14. GRID-DIP METER PHENOMENA IN THE UHF BAND

a. Grid-Current Variation:

Some minor resonances or rapid grid current versus frequency variations may be noticed at a few discrete frequencies within the tuning range of the Model 159 UHF. These are due to internal resonances in the oscillator. Through careful design these resonances, or "suck-outs", have been minimized.

These spurious resonances are easily identified, since they are independent of the coupling distance to the circuit under test, while the depth of the desired resonances depends on the closeness of coupling to the measured circuit.

b. Optimum Coupling Distance:

In most cases it is desirable initially to couple very closely to the circuit under test. The plastic coil housing may be placed in direct contact with the circuit. After a resonance has been detected the coupling distance should be increased.

It is highly desirable that the Model 159 UHF and the test circuit be held in fixed positions with respect to each other, because at 900 megacycles, for example, a variation in coupling distance of 1.3 inches is one-tenth of a wave length. Slight relative movements, therefore, "swamp out" grid current dips and make it extremely difficult to find a resonance.

It is desirable to tune very slowly in order not to overlook a sharp resonance. Many UHF circuits have a high Q and produce extremely sharp grid-current dips.

c. Dielectric Absorption:

Whenever possible, the circuit component under test should be kept away from lossy materials such as wooden or Masonite table tops, etc. These materials have high dielectric losses in the UHF band and will greatly reduce the Q of the circuit under test, or will load the grid-dip oscillator so heavily that resonances will not be distinguishable.

d. Radiation Phenomena:

Circuit elements to which the Model 159 UHF is coupled will often have dimensions which are a tenth of a wavelength, or longer, at the measuring frequency. These elements will, therefore, behave like antennas and they will radiate appreciable energy. If the person using the grid-dip meter moves any part of his body just a slight amount, the waves reflected from his body will react back on the grid-dipper with a resultant variation of grid current. This natural phenomenon may be mistaken for erratic behavior of the instrument. (This phenomenon is the same as that which is utilized in the proximity fuse). In order to prevent stray wave reflections from affecting the measurements, it is good practice to keep pieces of metal, instrument cases, etc., removed from the immediate measuring area.

A circuit element which behaves like an antenna and radiates an appreciable amount of electro-magnetic energy has an equivalent radiation resistance which reduces the Q of the element. Such an element will exhibit a broad, poorly-defined, resonance when coupled to a grid-dip meter.

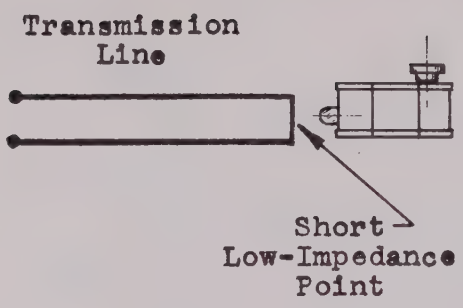


Fig. 2(a) Inductive Coupling

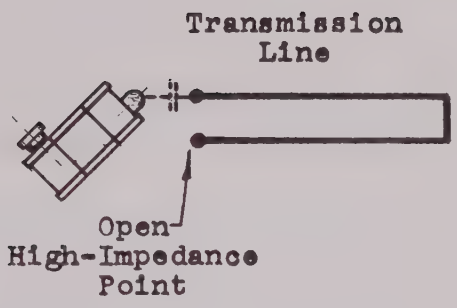
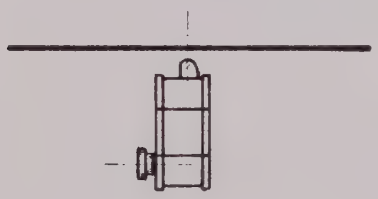
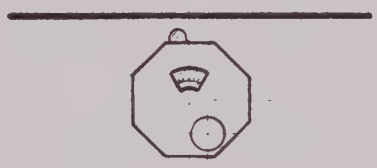


Fig. 2(b) Capacitive Coupling



Coil Orientation for
Maximum Inductive
Coupling

(a)



Coil Orientation for
Minimum Inductive
Coupling

(b)

Fig. 3 Inductive Coupling to a Length of Wire

APPENDIX I

1. STORAGE

a. Remove dust from controls and outer surface of instrument with a clean rag.

b. Wrap instrument in heavy wrapping paper and seal seams with gummed tape or similar adhesive.

c. Store in a dry place. If excessive humidity is unavoidable, the wrapped instrument should be placed in a moisture-proof bag with a sufficient quantity of drying agent, such as silica gel, to insure a dry atmosphere.

(1) When the use of bag and desiccant is necessary, the instrument should be checked at 6-month intervals to determine the effectiveness of the seal.

2. SHIPMENT

a. Wrap the instrument with heavy wrapping paper and seal seams with gummed tape or similar adhesive.

b. Place in fibre-board carton or wooden box large enough to permit at least 3 inches of excelsior or similar packing material between the instrument and sides of the box.

(1) For export packing, the instrument must be wrapped in waterproof paper and the seams sealed with glue or similar sealing compound before being placed in a wooden box.

PARTS LIST

APPENDIX II
TABLE OF PARTS
MODEL 159 UHF

Symbol	Measurements Part Number	Description
Capacitors		
C101	*	Variable Part of Meas. H-4614.
C102	*	Variable. Part of Meas. H-4614.
C103	*	Fixed; 13 mmf. Part of Meas. H-4614.
C104	*	Fixed; 13 mmf. Part of Meas. H-4614.
C105	H-5372	Fixed; ceramic 4.7 mmf 10%; 500 WVDC.
C106	H-6473	Fixed; ceramic 1000 mmf GMV.
C107	H-6473	Fixed; ceramic 1000 mmf GMV.
C108	H-6473	Fixed; ceramic 1000 mmf GMV.
Knob		
E101	H-7740-5	Round.
Foot		
H1	H-5507	Rubber.
Coils		
L101	*	Loop. Part of Meas. H-4635.
L102	H-4639	Coil; rf; choke.
L103	H-4636	Coil; rf; choke; 15 turns.
L104	H-4636	Coil; rf; choke; 15 turns.
L105	H-4638	Coil; rf; choke; 10 turns.
Connector		
P101	H-7744	Plug; male 6 prong.
Resistor		
R101	H-3734-471	Fixed; composition; 470 ohms 10%; 2 W.
R102	H-4728-153	Fixed; composition; 15 K ohms 10%; 1/2 W.
R103	H-4728-333	Fixed; composition; 33 K ohms 10%; 1/2 W.
Tube		
V101		Electron; triode; 6AF4A.
Cable		
W101	H-886	Flexible; 5 conductor.
	H-7705	Flexible; 5 conductor. Includes P101.
Socket		
XV101	*	Tube. Part of Meas. H-4614.

* Not recommended for field replacement.

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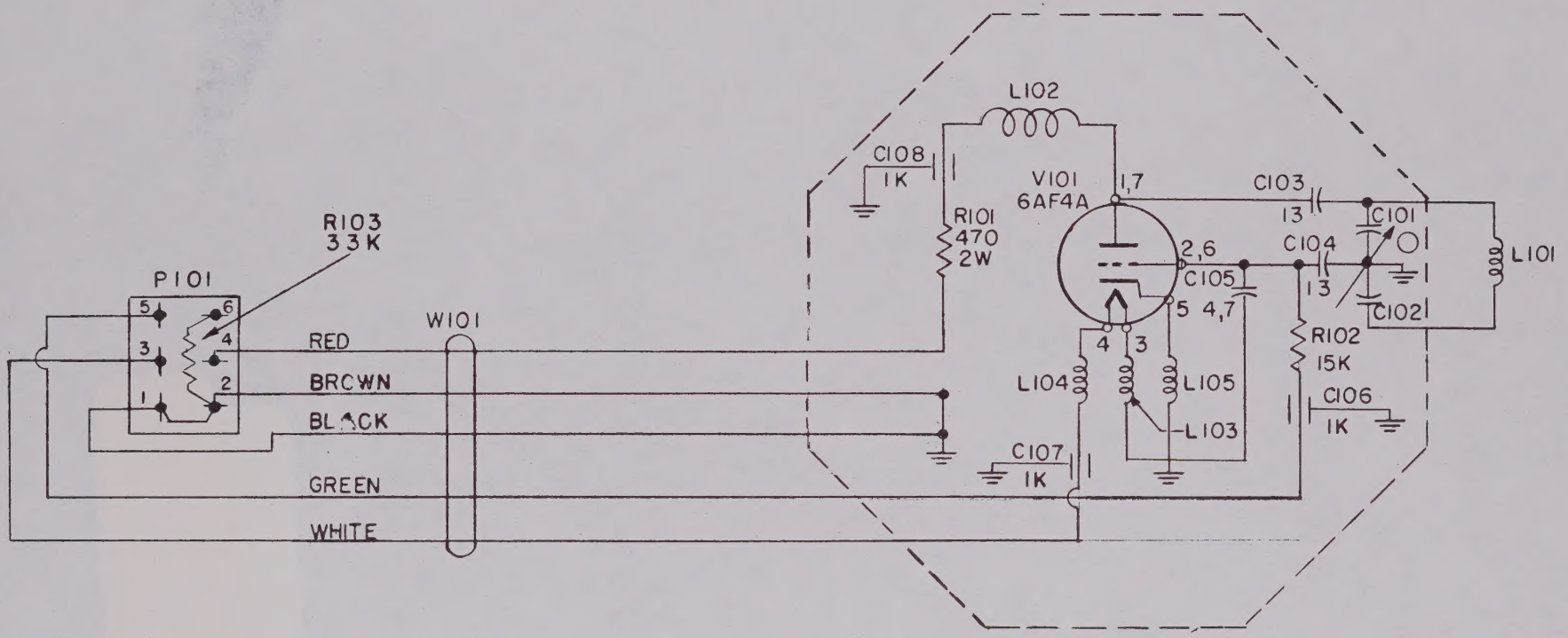


CONNECTOR VIEWED FROM SOLDERING TERM. END.

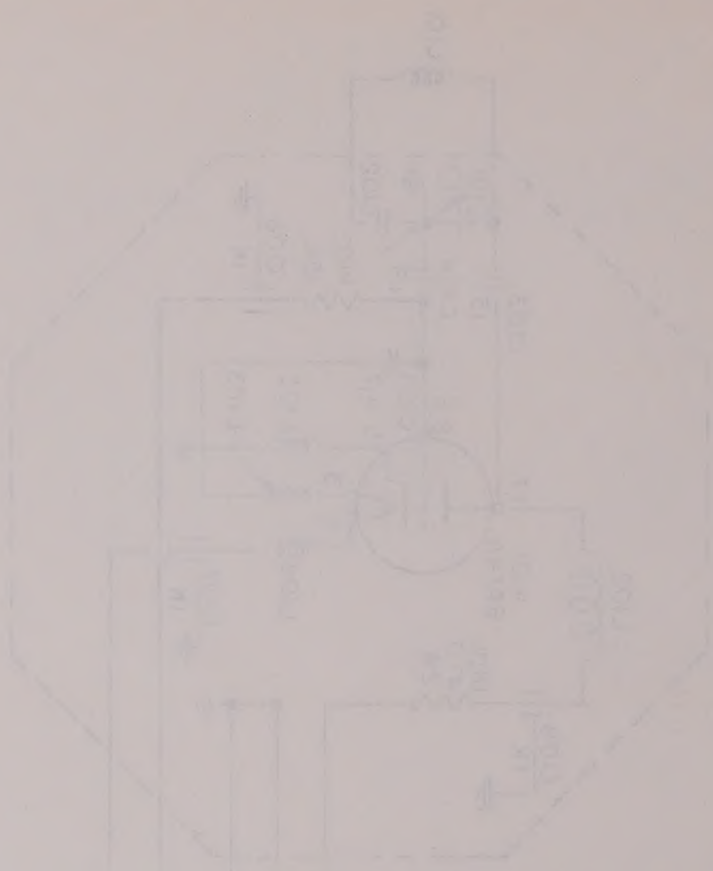
SCHEMATIC DIAGRAM
MODEL 159 UHF

UNLESS OTHERWISE SPECIFIED

ALL RESISTORS 0.5 WATT.
ALL CAPACITORS IN MMF.

○ =FRONT PANEL CONTROL

B-7709



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